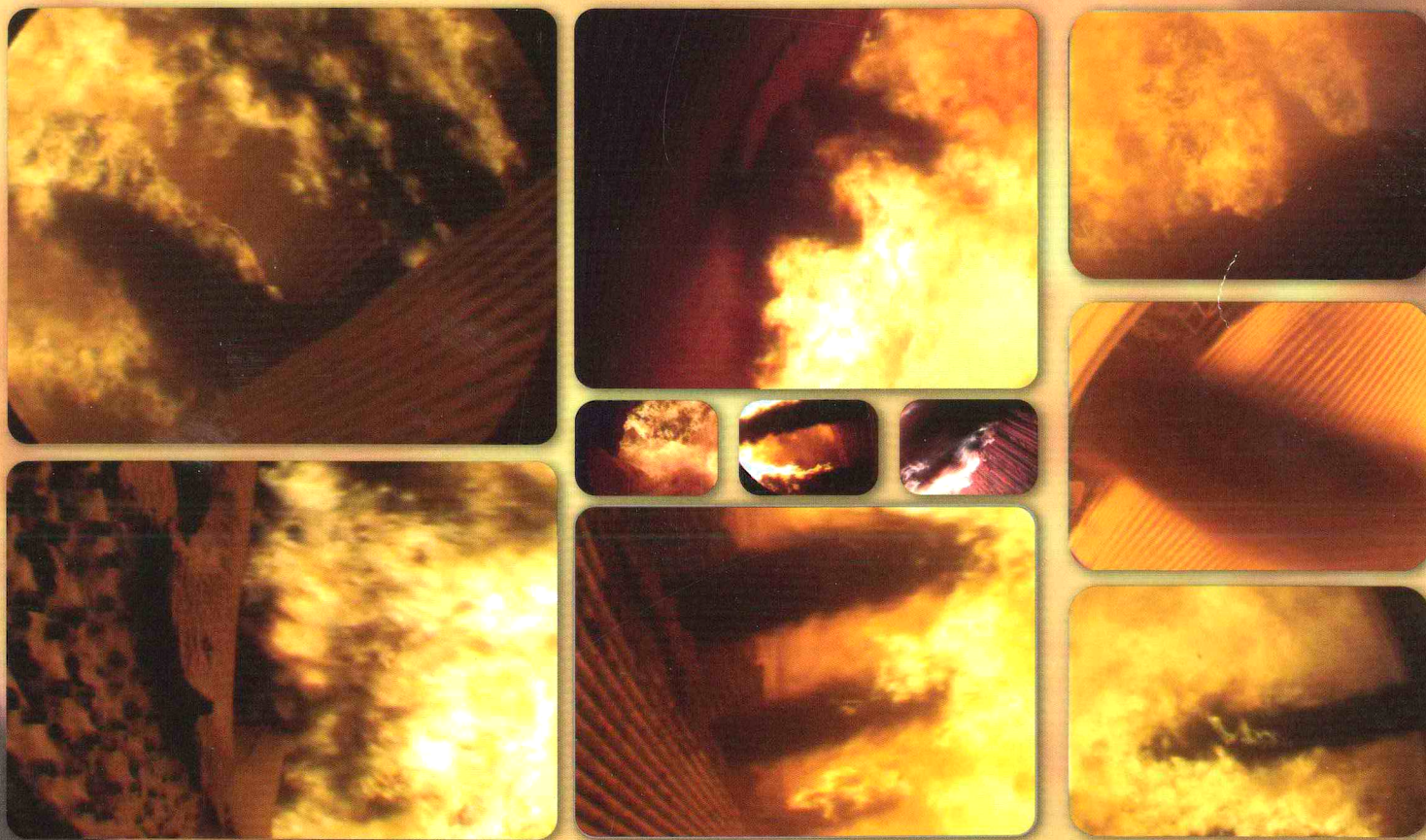




SAS Global Patented In-Line Diffuser

*Saving Millions and Millions of Dollars
Per Year with Very Minimal Investment*

• Reduce NO_x • Lower LOI • Reduce CO and O_2 • Reduce Slagging • Increase Burner Life



Are Low NO_x Burners Really Low NO_x?

Stoichiometric combustion ratios have a significant impact on boiler efficiency

Direct fired pulverized coal boilers require a specific air to fuel ratio range through the mill and fuel piping for proper fuel preparation and pneumatic transport to the boiler. Once to the boiler, different specific air to fuel ratios are required to support the various stages of combustion. These stoichiometric combustion ratios have a significant impact on boiler efficiency, maintenance and pollutant formation.

Low NO_x burners are designed to limit the formation of thermal NO_x and fuel bound nitrogen release by controlling air to fuel ratios to specific levels at various distances from the burner exit to 'stage' combustion. They are designed around an expected primary air to fuel ratio at the burner exit to produce ideal combustion air to fuel ratios. When segregation of coal and air into what is termed "Coal Ribbons" occurs, the primary air to fuel ratio expected at the burner exit changes significantly and is variable as illustrated below. This prevents the low NO_x burner from producing the ideal combustion air to fuel ratios it's intended to do. The stoichiometric relationship of coal and air for low NO_x and all other burners are based upon a homogeneous mixture of coal and air.

At the inlet end of every burner is an elbow, which creates coal ribbons that continue into the boiler. (See diagrams to the right) At the point fuel is released into the boiler for combustion the cross section of flow is one of varying air to fuel ratios-*ie*; heavy and light concentrations of air and fuel. The graphical examples below provide a good illustration of how the ratios can vary within the burner.

From the examples in the diagram it is evident that coal ribbons in the burner fuel piping create areas with very high air/fuel ratios. The areas high in airflow are well above complete stoichiometric combustion relationship and allow for premature ignition just inside the burner or at the very end of the burner nozzle. This very hot zone will eventually destroy a burner and instead of lowering NO_x it will have the opposite effect.

The same burner will also have coal ribbons that are extremely low in airflow and high in fuel. It will take longer and require more space in the combustion zone of the boiler for all of the coal to volatilize. In some cases even over fire air may not add enough oxygen for combustion to be completed. In general, fuel rich coal ribbons just don't have enough time to completely combust and can cause slagging. The release of excess heat in the back pass of the boiler will significantly increase the levels of LOI, and reduce unit Heat Rate.

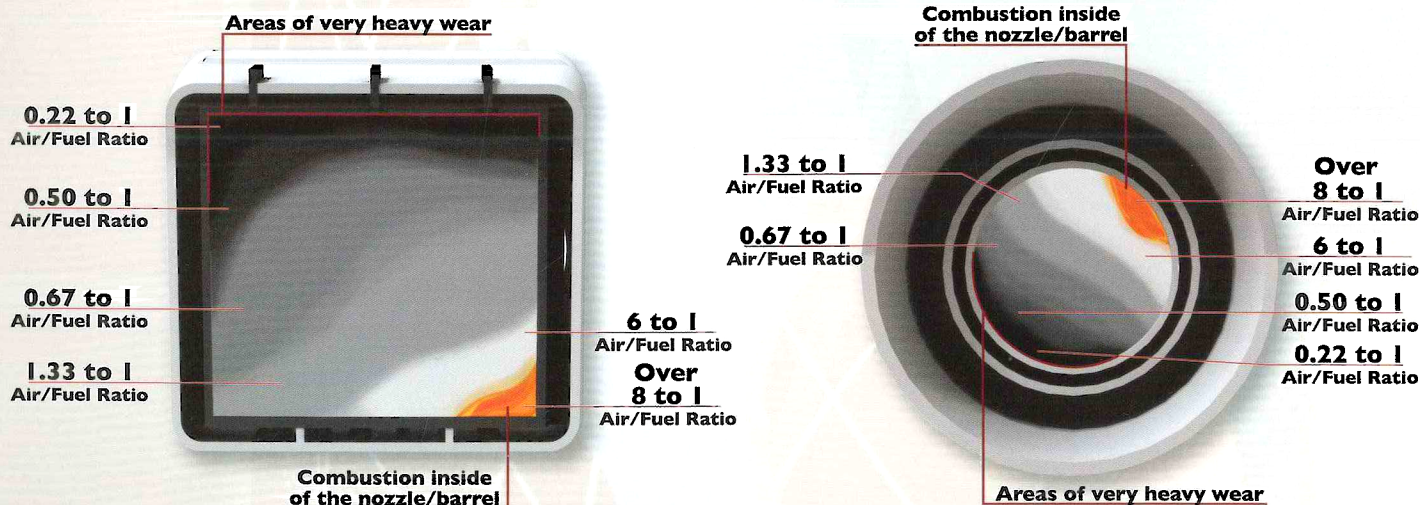
The success of Low NO_x burners has to be somewhat questionable when coal ribboning is present. Recent video footage, available upon request, confirms the poor quality of ignition at the burner face when coal ribboning is taking place.

The Solution

The SAS Global Patented In-Line Diffuser breaks up the coal ribbons as they enter the burner, which creates a homogeneous mixture of fuel and air. This provides the entire burner with a consistent air to fuel ratio for proper combustion.

Air to Fuel Ratios Within a Coal Pipe

Average Air/Fuel Ratio is assumed to be 2 pounds of air to 1 pound of coal
(round numbers used for illustrative purposes)

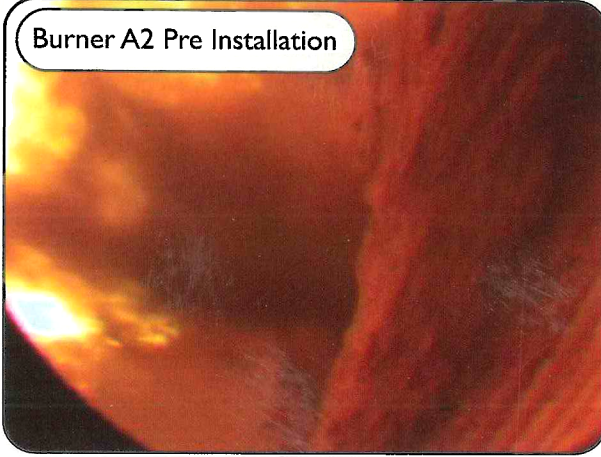


SAS Global Patented In-Line Diffuser

Visual Flame Comparisons & Physical Dust Modeling

Patented In-Line Diffuser Example Installation: Low NO_x Wall Fired Burner

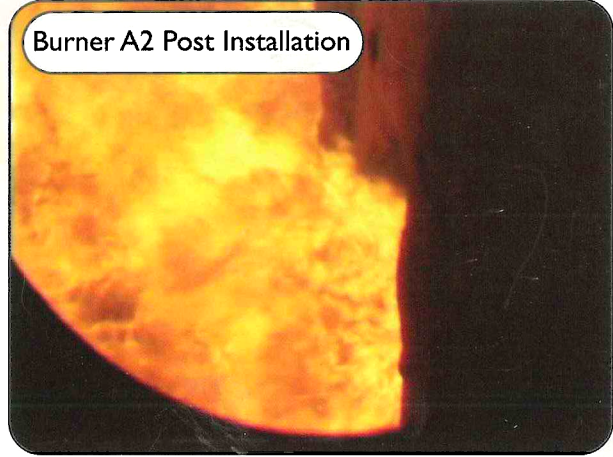
Burner A2 Pre Installation



Visual Signs of Poor Combustion

- Flame Detachment
- Areas of very heavy fuel
- Slagging around burner

Burner A2 Post Installation



Visual Signs of Improved Combustion

- Flame attached to the burner face
- Bright flame with proper fuel mixture
- Improved burner plume

Patented In-Line Diffuser: Physical Dust Modeling

Without SAS Patented In-Line Diffuser
Wall Fired Burner

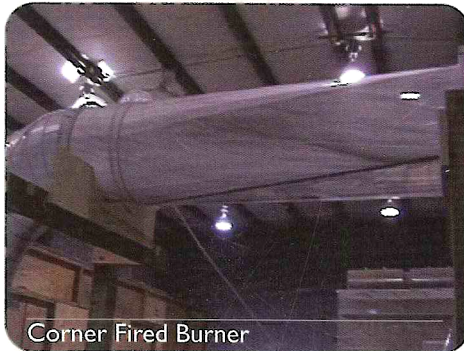


Heavy ribbons of segregated fuel are present in the burner without the SAS Patented In-Line Diffuser

With SAS Patented In-Line Diffuser
Wall Fired Burner

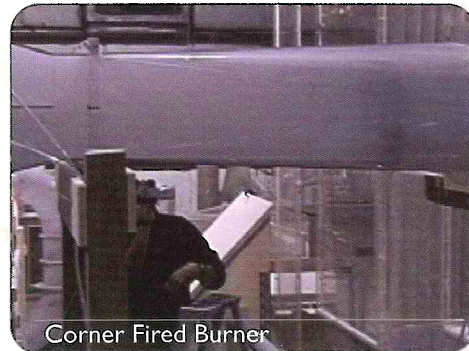


All heavy ribbons of fuel are broken up and mixed into a homogeneous mixture of fuel and air by the SAS Patented In-Line Diffuser



Corner Fired Burner

Without SAS Patented In-Line Diffuser



Corner Fired Burner

With SAS Patented In-Line Diffuser

SAS Global Patented In-Line Diffuser: Example Burner Diagrams

Lower NO_x , Reduce LOI, Reduce Slagging, Increase Burner Tip Life, Lower SCR Costs

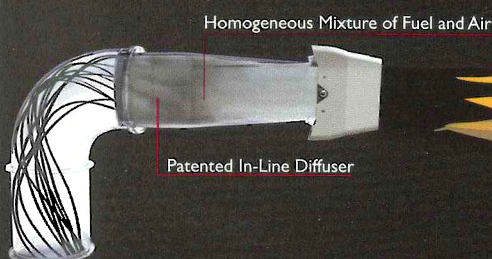
The Patented SAS Global Power In-Line Diffuser was designed to eliminate the coal ribboning and provide a homogeneous mixture of fuel and air flowing to the boiler. The SAS In-Line Diffuser is installed just after the last elbow or connection leading to the burner pipe. *Every type of burner manufactured will benefit from the In-Line Diffuser's ability to transform coal ribbons into a homogeneous flow to the boiler!*

T-Fired Burner Diagram



Flame without Patented In-Line Diffuser

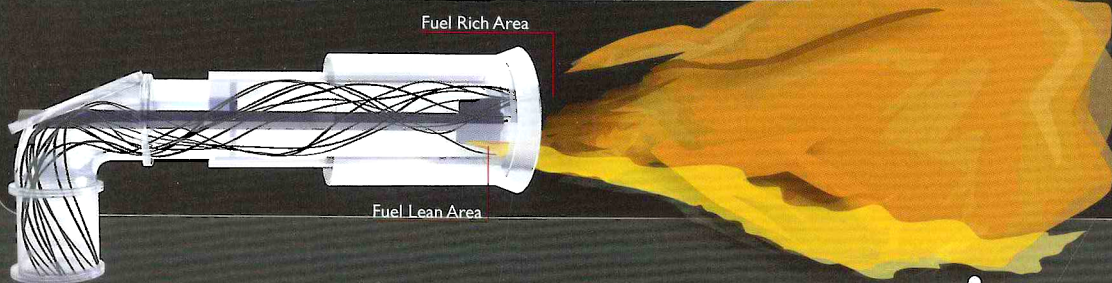
This picture indicates premature combustion due to the segregation of coal and air. Coal roping has created an area with a high air/fuel ratio where combustion first starts to take place, and unfortunately its right at the tip of the burner nozzle. The ignition continues from the exit of the burner along the entire top of the unmixed coal and air.



Flame with Patented In-Line Diffuser

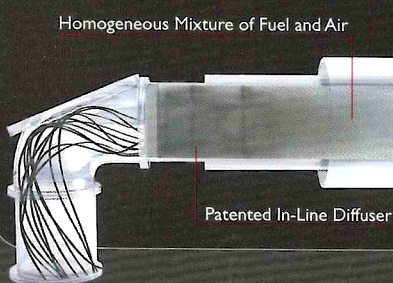
A homogeneous mixture of fuel and air is delivered to the tangent point of the center circle of the boiler. T-Fired units are designed to mix the air and coal from all the burners in the very center of the boiler. This flame is exactly where it is supposed to be and there will never be any concerns about burning or melting the burner nozzles. Secondary air and over fire air can now be used effectively for limiting NO_x formation.

Wall Fired Burner Diagram



Flame without Patented In-Line Diffuser

Delayed combustion due to the poor mixing of primary air and coal. Partial ignition of the coal is taking place while the majority of the coal has to travel much farther into the boiler before it mixes with air to start the combustion process. LOI, excessive burner nozzle wear, and boiler slagging are symptomatic with this condition.



Flame with Patented In-Line Diffuser

Clean burn which happens when air and coal are properly mixed. The entire outer area of the flame surrounds the contained inner fuel and air. This type of condition allows for controlling NO_x with the secondary air and over fire. Fuel bound Nitrogen can be released from inside the flame and form N_2 and not NO_x .

Lower NO_x , Reduce CO and O_2 , Reduce LOI, Reduce Slagging, Increase Burner Life

There have been record sales of the Patented In-Line Diffuser since it was introduced. There have now been 2000+ Patented SAS In-Line Diffusers sold throughout the globe. Why have they been selling so fast? One reason, they **WORK**.

CFD modeling has shown a major reduction in NO_x and improved combustion. This CFD modeling has led a large Power Utility to invest in **\$3,100,000.00 USD worth of Patented In-Line Diffusers, saving them millions per year in maintenance costs and emissions.**

*Millions and Millions of Dollars
Saved Per Year with
Very Minimal Investment*

*Find out how much you could be saving,
contact SAS Global today.*

*2000+ In-Line Diffusers Sold
and Growing by the Day*



USA & Canada

1674 Patented In-Line
Diffusers in Service

Europe

76 Patented In-Line
Diffusers in Service

Mexico

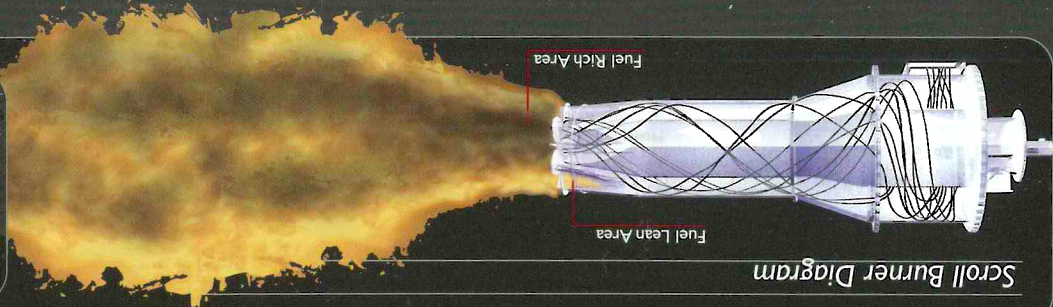
300 Patented In-Line
Diffusers in Service

South America

65 Patented In-Line
Diffusers in Service

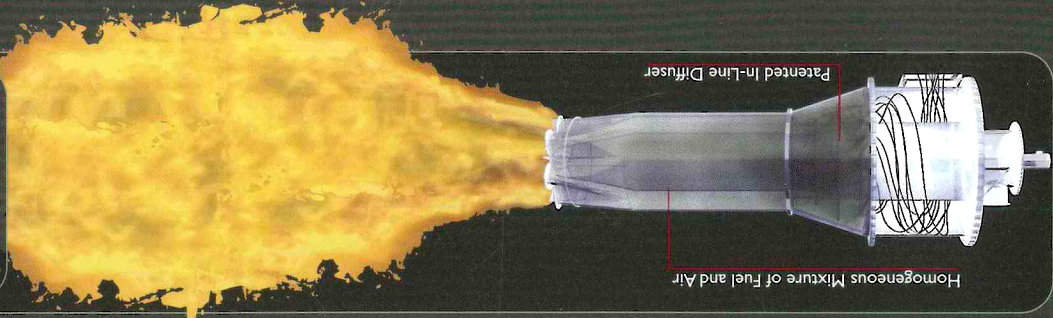


Scroll Burner Diagram

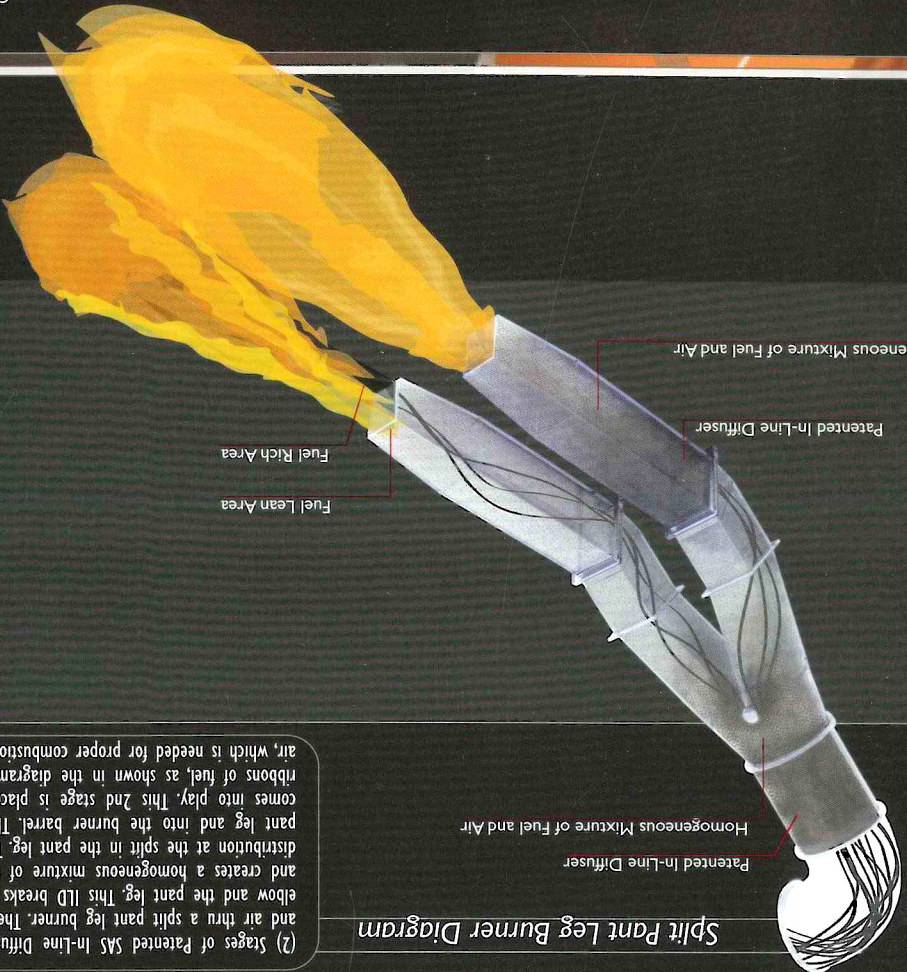


Flame without Patented In-Line Diffuser
Partial ignition of the coal is taking place due to the poor mixing of fuel & air. There is early ignition taking place inside the burner, while the majority of the coal has to travel much farther into the boiler before it mixes with air to start the combustion process. This causes LOL, excessive burner nozzle wear, and boiler slagging.

Flame with Patented In-Line Diffuser
Proper combustion is obtained due to the proper mixing of air and coal by the ILD. The entire outer area of the flame surrounds the contained inner fuel and air. This type of condition allows for controlling NO_x and other emissions. Proper combustion also reduces LOL, slagging, and increases burner life.



Split Pant Leg Burner Diagram



(2) Stages of Patented SAS In-Line Diffusers are required to properly mix and distribute the fuel and air thru a split pant leg burner. The first Patented In-Line Diffuser is located between the last elbow and the pant leg. This ILD breaks up the heavy concentrations of fuel created by the elbow and creates a homogeneous mixture of fuel and air entering the pant leg. This allows for proper distribution at the split in the pant leg. The coal will develop ribboning again as it travels thru the pant leg and into the burner barrel. This is where the 2nd stage of Patented In-Line Diffusers comes into play. This 2nd stage is placed at the start of the burner barrel. It breaks up these ribbons of fuel, as shown in the diagram to the left, creating a homogeneous mixture of fuel and air, which is needed for proper combustion.

Have You Seen Your Flames Lately?

Call SAS Global today and have a look at your flames utilizing our portable high temperature boiler camera system. Your flame conditions have never been easier to inspect.

